CLAIM(S)

What is claimed is:

1. A process for recovering chlorine by oxidizing a stream comprising metal chlorides, comprising the steps of:

(a) feeding a pre-heated oxygen containing gas into one end of a tubular reactor;

(b) contacting the pre-heated oxygen containing gas at temperature T_{Ox} and velocity v_{Ox} with the stream comprising metal chlorides at temperature T_{mx} and velocity v_{mx} wherein the metal chlorides are selected from the group consisting of iron chlorides and mixtures of transition, alkali and alkaline-earth metal chlorides existing in the form of entrained solids, entrained liquids, vapors and mixtures thereof;

(c) introducing non-reactive scrubbing media at temperature T_s and velocity v_s into the reactor; and

(d) at least partially reacting the pre-heated oxygen containing gas with the stream comprising metal chlorides, wherein the walls of the tubular reactor are cooled externally to a temperature range of from about 0 to 500°C and wherein the temperature of the combined oxygen containing gas, metal chlorides and scrubbing media streams is greater than temperature T_{Rx}, the minimum temperature required to initiate oxidation of the metal chlorides and wherein the combination of v_{Ox}, v_{mx} and v_s provides at least enough energy to the scrubbing media to remove wall deposits as fast as the deposits are formed.

2. The process of claim 1 wherein the walls of the tubular reactor are cooled to a temperature of from 150 to 500°C.

3. The process of claim 1 wherein a substantial portion of the walls of the tubular reactor are cooled to a temperature of from 250 to 400°C.

4. The process of claim 1 wherein the walls of the reactor are cooled in two or more stages to intermediate temperatures of from 0 to 500°C.

5. The process of claim 1 wherein the temperature T_{Rx} is sustained for at least 0.1 seconds after the pre-heated oxygen-containing gas contacts the stream containing the metal chlorides.

6. The process of claim 1 wherein the scrubbing media is fed into the reactor at one or more positions wherein the positions are selected from the group consisting of (a) one or more positions located between the position where the pre-heated oxygen containing gas enters the reactor and the position where the pre-heated oxygen containing gas and stream comprising metal chlorides are contacted, (b) one or more positions located downstream of the location where the stream comprising metal chlorides is fed into the reactor, and (c) a position or positions where the scrubbing media is fed simultaneously with the stream comprising the metal chlorides.

7. The process of claim 6 wherein immediately downstream of the position where the stream comprising metal chlorides is fed into the reactor, a purge gas is introduced through a purged wall of the reactor.

8. The process of claim 1 wherein the scrubbing media is selected from the group consisting of SiO_2, ZrO_2, TiO_2, Fe_2O_3, beach sand, titanium ore, olivine, garnet, titanium carbide, dolomite, petroleum coke, salt, and like materials.

9. The process of claim 1 wherein the pre-heated oxygen containing gas is heated to a temperature of from 1000 to 2500°C.

10. The process of claim 1 wherein the pre-heated oxygen containing gas is heated directly or indirectly.

11. The process of claim 1 wherein the pre-heated oxygen containing gas is heated by a burner, a pebble heater, electrical resistance heater, and plasma torch.

12. The process of claim 1 wherein the stream comprising metal chlorides is added by one or more means selected from the group consisting of a tee mixer, an axial slot, a radial slot, and a coaxial center-feed nozzle.

13. The process of claim 1 further comprising introducing a first conveying gas with the scrubbing media and a second conveying gas with the stream comprising metal chlorides and wherein the combination of the pre-heated oxygen containing gas, and the first and second conveying gases forms a bulk gas in the reactor.

14. The process of claim 13 wherein the bulk gas has a velocity V_b sufficient to remove wall deposits as fast as such deposits are formed.

15. The process of claim 13 wherein the first and second conveying gas is selected from the group of gases consisting of oxygen, process product gas, nitrogen, carbon monoxide, carbon dioxide, inert gases and mixtures thereof.

16. The process of claim 1 wherein the oxygen content of the oxygen containing gas is at least the amount needed to stoichiometrically oxidize the metal chlorides content present in the stream comprising metal chlorides.

17. The process of claim 1 wherein the stream containing metal chlorides is injected concurrently into the center of an axially-flowing stream of pre-heated oxygen containing gas and scrubbing media.

18. The process of claim 17 wherein the position and relative geometry where the preheated oxygen is fed into the reactor relative to the position where the pre-heated oxygen containing gas and the stream comprising metal chlorides are contacted is modified to impart a swirl component into the velocity of the preheated oxygen containing gas.

19. The process of claim 1 wherein the ratio of the weight of scrubbing media to the weight of metal chlorides present in the stream comprising metal chlorides is at least 0.05.

20. The process of claim 17 or 18 wherein the ratio of the velocity of the oxygen containing gas to that of the metal chloride conveying gas is at least 2 to 1.

21. A tubular reactor useful in the recovery of chlorine from a stream comprising metal chlorides, the reactor having a feed end and an exit end separated by a length of wall having a diameter D and wherein disposed in the wall near the feed end of the reactor are two or more means for feeding two or more feed streams comprising (a) a first stream comprising hot oxygen, (b) a second stream comprising scrubbing media, and (c) a third stream comprising a metal chloride stream wherein the third stream is fed through a third means for feeding or fed simultaneously with the scrubbing media and wherein the reactor includes a means for pre-heating at least one of the feed streams and wherein the diameter D is varied along the length of wall of the reactor and wall temperature is controlled by an external cooling means at least over a portion of the wall's length.

22. The reactor of claim 21 wherein the stream comprising metal chlorides is fed by one or more means selected from the group consisting of a tee mixer, an axial slot, a radial slot, and a coaxial center-feed nozzle.

23. The reactor of claim 21 wherein the scrubbing media particles are fed by one or more means selected from the group consisting of a tee mixer, an axial slot, a radial slot, and a coaxial center-feed nozzle.

24. The reactor of claim 21 wherein a portion of the reactor's wall is a purged wall.

25. The reactor of claim 20 wherein the gas comprising hot oxygen is fed first into the reactor, followed by scrubbing media forming a combined feed stream of hot oxygen gas and scrubbing media which is then contacted by the feed stream comprising metal chlorides.

26. The reactor of claim 21 wherein the scrubbing media is fed into the reactor at one or more positions wherein the positions are selected from the group consisting of (a) one or more positions located between the position where the pre-heated oxygen containing gas enters the reactor and the position where the pre-heated oxygen containing gas and stream comprising metal chlorides are contacted, (b) one or more positions located downstream of the location where the stream comprising metal chlorides is fed into the reactor, and (c) a position or positions where the

scrubbing media is fed simultaneously with the stream comprising the metal chlorides.

27. The reactor of claim 21 wherein the walls are cooled by means of a jacket having one or more pair of inlets and outlets through which one or more cooling fluids are circulated to control the wall temperature.

28. The reactor of claim 21 wherein the means of pre-heating gas is selected from the group consisting of a burner, a pebble heater, electrical resistance, heater and plasma torch.